

The UCSD/SDSU Mathematics and Science Education
Doctoral Program Proudly Presents a Dissertation Defense:

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The Development of Mathematical Knowledge for Teaching for Quantitative Reasoning using Video-Based Instruction

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Quantitative reasoning (Thompson, 1990, 1994) is a powerful mathematical tool that enables students to engage in rich problem solving across the curriculum. One way to support students' quantitative reasoning is to develop prospective secondary teachers' (PSTs) mathematical knowledge for teaching (MKT; Ball, Thames, & Phelps, 2008) related to quantitative reasoning. However, this may prove challenging, as prior to entering the classroom, PSTs often have few opportunities to develop MKT by examining and reflecting on students thinking. Videos offer one avenue through which such opportunities are possible.

In this study, I report on the design of a mini-course for PSTs that featured a series of videos created as part of a proof-of- concept NSF-funded project. These MathTalk videos highlight the ways in which the quantitative reasoning of two high school students developed over time.

Using a mixed approach to grounded theory, I analyzed pre- and post-interviews using an extant coding scheme based on the Silverman and Thompson (2008) framework for the development of MKT. This analysis revealed a shift in participants' affect as well as three distinct shifts in their MKT around quantitative reasoning with distances, including shifts in: (a) quantitative reasoning; (b) point of view; and (c) orientation toward problem solving.

Using the four-part focusing framework (Lobato, Hohensee, & Rhodehamel, 2013), I analyzed classroom data to account for how participants' noticing was linked with the shifts in MKT. Notably, their increased noticing of aspects of MKT around quantitative reasoning with distances, which features prominently in the MathTalk videos, seemed to contribute to the emergence of the shifts in MKT.

Results from this study link features from the learning environment to the development of specific facets of MKT around quantitative reasoning with distances. These connections suggest that vicarious experiences with two students' quantitative reasoning over time was critical for participants' development of MKT.